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Unveiling use of Information and Communication Technology (ICT) in Western Uttar Pradesh, India: The Farmers' Perspective

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This study examines the dynamics of information utilization in agricultural practices among 200 farmers in Western Uttar Pradesh, India. The survey covered a diverse range of participants across various age groups and income brackets. The findings of the study reveal a significant dependence on radio broadcasts, as 56.5% of the participants reported using this medium, especially among individuals with weak literacy abilities. The demographic cohort consisting of individuals aged 35-50 shown the highest level of engagement in utilising information, whilst younger age groups exhibited a preference for online resources. Surprisingly, the study revealed a minimal correlation between farming experience and the adoption of agriculture helplines. However, a clear association emerged between higher income levels and increased utilization of radio and online services in the agricultural sector. The research highlights the necessity for extension service workers to receive training in contemporary information and communication technology (ICT) technologies in order to enhance their ability to effectively support agricultural communities.

Keywords: Radio broadcast, agriculture helpline number, Tv broadcast, internet services, income, education.

INTRODUCTION

Information and communication technology (ICT) has become a crucial part of many businesses in the modern, fast-expanding world, and agriculture is no different. ICT use in the agricultural sector has ushered in a new age by converting outdated farming methods into effective, data-driven procedures. ICT technologies and solutions are being adopted by farmers all over the world in an effort to improve production, optimise agricultural practises, and combat issues like food security, climate change, and resource scarcity (Khan *et al.,* 2022) However, agricultural productivity in emerging nations has long lagged substantially behind that of industrialised nations, despite the fact that agriculture can be a significant driver of economic growth in these nations. Utilising more advanced agricultural technologies, such as fertilisers, seeds, and cropping methods, is one potential way to increase yields. By offering agricultural extension services, public-sector programmes have tried to get over information-related barriers to technological adoption (Aker 2011). Farmers employ a variety of information sources, some of which may be replacements or complementary to one another. This suggests that no single source can provide all of the information a farmer demands (Mittal and Mehar 2015).

India is currently going through a phase of the communication revolution, which has resulted in a notable increase in the use of media in mass communication. It is now a crucial component of programmes for the development of health, nutrition, agriculture, family planning, education, local economies, and global empowerment. The major challenges faced by the farmers in Western Uttar Pradesh are such as outdated agricultural practices, land fragmentation, market access, credit crunch, weather uncertainties, pest and disease management, lack of mechanization, educational gaps and policy implementation which could be resolved by the use of ITC by the farmers. By integrating Information and Communication Technology into agriculture, farmers in Western Uttar Pradesh can not only overcome existing

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challenges but also enhance their overall productivity, sustainability, and economic well-being. It requires a concerted effort from government bodies, tech developers, and agricultural stakeholders to ensure the effective adoption and implementation of ICT solutions in the farming community. When it comes to getting information from a research system to farmers, satellite-based internet connections have proven to be one of the most effective, precise, rapid, and relatively less expensive methods of communication accessible (Manjeet and Kumar 2019). Modern information and communication technology methods have a higher ability for effective communication than traditional sources.

The prime objective of this study is to identify the perceptions of the farmer community towards information and communication technologies and the relationship between different demographic characteristics of the respondents and the use of information and communication technology through TV, agriculture helplines, internet services, and radio. The paper is structured as follows: Firstly, the background highlights the global adoption of ICT in agriculture and the challenges faced by farmers, with a specific focus on Western Uttar Pradesh. It also emphasizes the potential of ICT to address these challenges. The heart of the study lies in the methodology, which details the approach taken to gather and analyze data on farmers' perceptions of ICT. The findings section presents the outcomes of the study, focusing on the relationships between demographic factors and ICT utilization. Finally, the paper concludes with recommendations and suggestions on how agricultural extension education can be optimized to meet the evolving needs of farmers, promoting sustainable and productive farming practices in the region. This structure aims to guide readers through the research journey, providing a roadmap for understanding the study's objectives, methodology, and key findings.

MATERIALS AND METHODS

The present study was conducted in an area of Western Uttar Pradesh, which constituted six divisions. The preliminary part of the research study undertaken in Western Uttar Pradesh was centred on establishing the necessary foundation for the subsequent data gathering and analysis procedures. The objective of this study was to examine the factors contributing to the restricted perspective on the utilisation of information and communication technology (ICT) in the agricultural sector. The geographical region under investigation, Western Uttar Pradesh, is widely recognised for its notable agricultural output, encompassing crops such as sugarcane, wheat, maize, rice, and mango, as well as a diverse range of fruits and vegetables. The soil composition in the area is classified as sandy loam, which is characterised by a mixture of sand, silt, and clay particles. The prevailing climate conditions are conducive to agricultural pursuits, providing favourable conditions for crop cultivation. Additionally, the region benefits from ample water resources, which ensure sufficient water availability for irrigation purposes.

The research commenced by identifying six distinct divisions, from which two were subsequently chosen in a random and unbiased manner. Two districts were picked from each division (Meerut and Saharanpur) which are Meerut and Hapur (Meerut Division) and Muzaffarnagar and Saharanpur (Saharanpur Division) and four villages were randomly chosen from each district as depicted in the Fig. 1. The villages selected were Jhitkari, Bharala, Alipur and Bhamori (Meerut District), Amipur Nagola, Asodha, Shimbhaoli and Himmat Nagar (Hapur District), Manoharpur, Mohanpur Gada, Nalheda Gazi and Saliri (Saharanpur District) and Badheri, Chhetela, Jat Majhra and Luhari (Muzaffarnagar). The employed sampling approach effectively secured the inclusion of a representative assortment of places for the study. Upon identifying the villages, the research team proceeded to develop a comprehensive list of contact farmers by leveraging the resources available from both the agriculture department and the village sarpanch. In order to provide a representative sample for the study, a random selection of 10% of the entire population of contact farmers was obtained by employing a sample random number table. In order to gather the necessary data, a meticulously crafted questionnaire was developed, ensuring its alignment with the aims of the study. Prior to the integration of the questionnaire into the primary study, a preliminary testing phase was undertaken, involving a cohort of around 50 farmers who were not included in the final sample of the study. The process of pre-testing enabled the researchers to detect any possible concerns pertaining to the structure, language, or clarity of the questionnaire. Furthermore, the assessment of the questionnaire's reliability and validity was conducted during the pre-testing phase.

During the process of data collection, respondents were questioned in their respective native languages and at locations that were convenient for them. This approach was implemented to enhance response rates and improve the accuracy of the gathered information. Subsequently, the gathered data was methodically condensed, classified, and organised into tables in order to facilitate subsequent analysis. The data underwent thorough statistical analysis using the Statistical Package for the Social Sciences (SPSS) software.

Chi-squire test: A statistical test that examines the differences between categorical variables from a random sample in order to determine whether the expected and observed results are well-fitting.

$$\chi^2 = \sum (O - E)^2 / E$$

where O = Observed frequency, E = Expected frequency, $\sum$ = Summation. χ^2 = Chi-Square value, Degree of freedom: Maximum number of logically independent values, which may vary in a data sample. Degrees of freedom are calculated

by subtracting one from the number of items within the data sample.

$$df = (r-1)\,(c-1)$$

where, r = the number of rows; c = the number of columns

This facilitated their ability to identify trends, correlations, and potential factors that impact agricultural production and productivity in the region, with a specific focus on analysing the influence of ICT adoption. In general, the preliminary phase established the groundwork for a systematic and thorough research investigation with the objective of examining the perception of information and communication technology (ICT) utilisation in the agricultural sector in Western Uttar Pradesh.

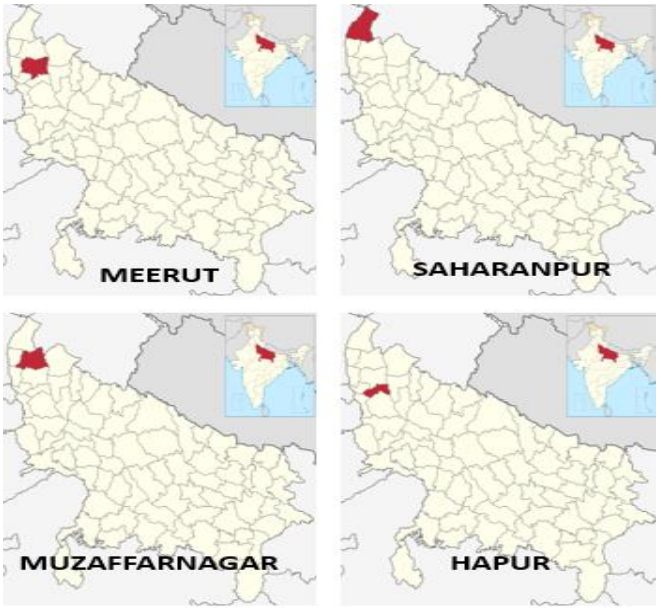

Figure 1. Location of selected districts for the study.

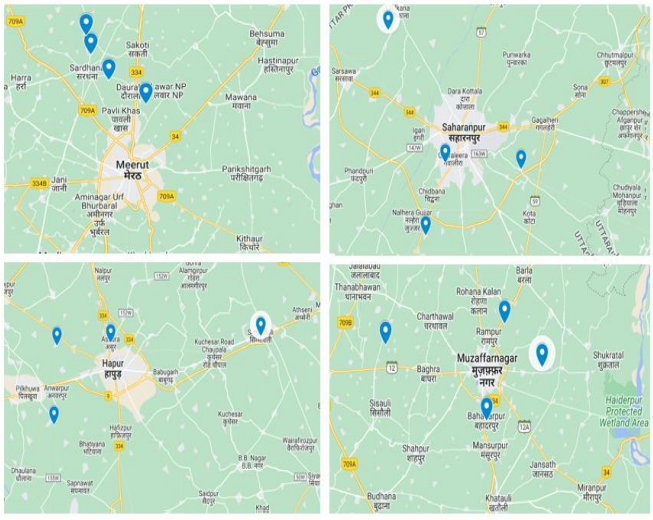

Figure 2. Location of selected villages for the study.

RESULTS

***Demograpic Characteristics of Respondents*:**

***Age of Respondents*:** Table 1 and Figure 3 display demographic data for 200 participants from designated regions. The study identifies four age cohorts: those below 25 (11%), those between 25 and 35 (34.5%), those aged 35 to 50 (33%), and those above 50 (21.5%). The data shows a significant presence of individuals between the ages of 25 and 35, which may indicate the intended target audience or a major age cohort among the surveyed community. Research suggests age significantly influences innovation diffusion, with younger farmers being less resistant to change and adopting new technologies more quickly, leading to an accelerated diffusion rate.

***Level of Education*:** The table also presents the educational attainment of the participants, categorising them into five groups: illiterate (30 respondents or 15%), primary education (46 or 23%), junior high school (47 or 23.5%), secondary education (40 or 20%), and graduation and above (37 or 18.5%). The data indicates a wide range of educational backgrounds, with a minor inclination towards intermediate-level schooling (Junior high school). Educated individuals are expected to have more favourable attitudes towards agricultural skills, knowledge, and information compared to those who are uneducated.

***Land Ownership*:** The occupancy status of the sample of 200 persons is presented, with 85 individuals (42.5%) identifying themselves as owners, 65 (32.5%) as tenants, and 50 (25.0%) having a dual status as both an owner and a tenant. This suggests a prevalence of homeownership among the respondents, which may indicate a group that is potentially stable or economically powerful. The table presents data on 200 farmers based on their land size, with marginal farmers accounting for 12% of the total, small farmers for 31%, medium farmers for 34%, and large farmers for 23%. A significant proportion of individuals had land holdings of moderate size, indicating a socio-economic framework characterised by a middle-agrarian system.

***Occupation of the Respondents*:** The table also shows data on non-agricultural occupations, with 68% of the sample engaging in another occupation. 19.5% of the surveyed population possess a small-scale dairy operation, while 60.5% engage in medium-scale dairy farming, maintaining 4-6 milch animals. The remaining 20% are involved in large-scale dairy production, characterised by a medium-scale dairy farming approach. The table also categorises 200 farmers based on their level of agricultural experience, with 12% having professional experience ranging from 1 to 5 years, 25% having 6 to 10 years, 33.5% having 11 to 15 years, and 29.5% having over 15 years of professional experience. The data reveals a notable clustering of farmers with 11–15 years of experience in the field, suggesting a prevalence of well-established agricultural methods.

Table 1. Demographic data of respondents in Western U.P. (India).

Age of Respondents	**N**	**P**
Below 25	22	11.0
25-35	69	34.5
35-50	66	33.0
Above 50	43	21.5
Total	**200**	
Tenancy status		
Owner	85	42.5
Tenant	65	32.5
Owner cum tenant	50	25.0
Total	**200**	
Occupation other than Agriculture		
No	64	32.0
Yes	136	68.0
Total	**200**	
Farming experience (years)		
1-5	24	12.0
6-10	50	25.0
11-15	67	33.5
Above 15	59	29.5
Total	**200**	

Education	**N**	**P**
Illiterate	30	15.0
Primary Education	46	23.0
Junior high school	47	23.5
Secondary Education	40	20.0
Graduation and above	37	18.5
Total	**200**	
Size of land holding (hectare)		
Marginal farmer (Below 1)	24	12.0
Small farmers (1-2)	62	31.0
Medium (2-10)	68	34.0
Large (10 and above)	46	23.0
Total	**200**	
Livestock Position		
No live-stock rearing	-	0.0
Small dairy (1-3 milch animals)	39	19.5
Medium dairy (4-6 milch animals)	121	60.5
Large dairy (More than 6 milch animals)	40	20.0
Monthly income INR (in thousand)		
1-10	5	2.5
11-20	30	15.0
21-30	44	22.0
31-40	73	36.5
Above 40	48	24.0
Total	**200**	

***Monthly income of Respondents*:** The table also categorises 200 individuals based on their monthly income in Indian rupees (INR), with the majority of responses falling within the income category of 31–40k, indicating a prevalence of middle-income individuals.

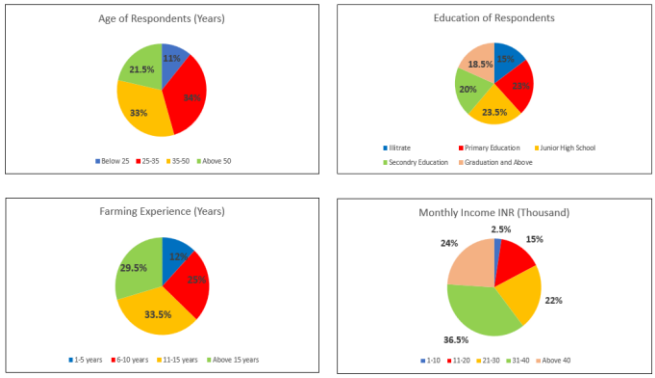

Figure 3. Demographic data of respondents in Western U.P. (India).

The demographic data unveils a predominantly young and educated farming community, with a significant concentration in the 25-35 age group, suggesting a potential target audience for agricultural initiatives. Education levels vary, but a slight inclination towards intermediate-level schooling is noted. Landownership is prevalent, indicating stability or economic strength. Land size distribution suggests a middle-agrarian system. A substantial portion engages in non-agricultural occupations, with a notable focus on medium-scale dairy farming. Experienced farmers with 11-15 years dominate, implying reliance on well-established agricultural methods. The majority falls within the 31–40k income range, pointing to a prevalent middle-income demographic.

***Perception of farmers towards ICT*:** Table 2 and Figure 4 show farmers' perceptions of information and communication technology (ICT) technologies. Participants rate each instrument using a 5-point Likert scale, with a majority of respondents either agreeing or strongly agreeing, suggesting that radio broadcasts are widely perceived as effective. Radio broadcasts have a significant proportion of respondents (37%) indicating uncertainty or a lack of a definitive stance, but 36% perceive them as beneficial. TV broadcast programmes exhibit a state of indecision among viewers, possibly due to fluctuating content quality or limited accessibility. A small percentage of respondents express agreement, but 19% firmly affirm the efficacy of these programs. The percentage of those who have not made a decision regarding internet services remains high at 65.5%, but 34.5% perceive the internet as useful, indicating an increasing dependence on online sources for obtaining agricultural knowledge.

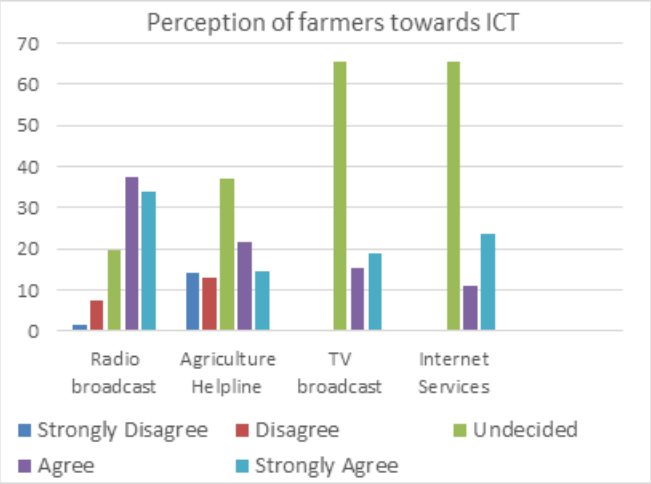

Figure 4. Perception of farmers towards Information and Communication Technology.

The Relationship between age of the respondents and the application of information through ICT

***The Relationship between age of the respondents and the application of information via radio*:** Table 3 and Figure 5 present empirical data on the utilisation of information received via radio across four age groups: Below 25, 25–35, 35–50, and Above 50. The majority of participants (55.5%) reported actively using the information they received, while 44.5% did not. The age group ranging from 35 to 50 had the most significant proportion of applications, amounting to 19.5%. However, the Chi-square test showed a lack of significance, suggesting that the observed variations in application rates may be attributed to random chance rather than a genuine disparity.

***The Relationship between age of the respondents and the application of information via Agriculture Helpline Number*:** The table and figure also show the utilisation of information obtained from an agriculture helpline number

Table 2. Perception of farmers towards Information and Communication Technology.

ICT	SD		D		UD		A		SA	
	N	P	N	P	N	P	N	P	N	P
Radio broadcast	3	1.5	15	7.5	39	19.5	75	37.5	68	34.0
Agricultural helpline Number	28	14.0	26	13.0	74	37.0	43	21.5	29	14.5
TV broadcast programs	-	-	-	-	131	65.5	31	15.5	38	19.0
Internet services	-	-	-	-	131	65.5	22	11.0	47	23.5

Table 3. Chi-Square test for the relationship between age of the respondents and the application of information through ICT.

	Age (Years)							
Do they apply the information receive through Radio?	**Below 25**	**25-35**	**35-50**	**Above 50**	**Total**	**Chi-square**	**Df**	**p-value**
Yes	4.5%	18.0%	19.5%	13.5%	55.5%	3.475	3	0.323[NS]
No	6.5%	16.5%	13.5%	8.0%	44.5%			
Total	11.0%	34.5%	33.0%	21.5%	100%			
Chi-Square for the relationship between the age of the respondents and the application of information received through Agriculture helpline								
Do they apply the information receive through Agriculture helpline number?								
Yes	6.5%	19.0%	17.0%	11.5%	54.0%	0.43	3	0.933[NS]
No	4.5%	15.5%	16.0%	10.0%	46.0%			
Total	11.0%	34.5%	33.0%	21.5%	100%			
Chi-Square for the relationship between the age of the respondents and the application of information received through TV								
Do they apply the information receive through TV?								
Yes	7.5%	21.0%	18.5%	9.0%	56.0%	5.478	3	0.139[NS]
No	3.5%	13.5%	14.5%	12.5%	44.0%			
Total	11.0%	34.5%	33.0%	21.5%	100%			
Chi-Square for the relationship between the age of the respondents and the application of information received through Internet services								
Do they apply the information receive through Internet?								
Yes	8.0%	22.5%	15.5%	8.0%	54.0%	12.795	3	0.005*
No	3.0%	12.0%	17.5%	13.5%	46.0%			
Total	11.0%	24.5%	33.0%	21.5%	100%			

[NS] Non-Significant ; *Highly Significant

among four age cohorts. 54% of participants adhered to the guidance provided, with the age group of 25–35 having the highest compliance rate at 19%. However, 46% did not use or implement the provided information. The age group distributions for both categories exhibit notable similarities, with a p-value of 0.933 suggesting no statistically significant variation in behaviour when comparing different age groups.

***The Relationship between age of the respondents and the application of information via television*:** Table and Figure show that 56% of information received through television is applied, with the highest rate in the 25-35 age group at 21%. However, 44% of individuals do not use or implement the information. A Chi-square test analysis shows no significant association between age and television information usage.

***The Relationship between age of the respondents and the application of information via internet*:** The table and figure also depict the patterns of information use from the internet across various age groups. The age group between 25 and 35 years had the most notable rate of application, amounting to 22.5%. The age group between 35 and 50 had a larger percentage of non-application (17.5%) compared to application (15.5%). The Chi-square test yielded a p-value of 0.005, indicating statistical significance. This suggests a substantial relationship between age groups and their propensity to use knowledge obtained through the internet. Younger age cohorts, particularly those between the ages of 25 and 35, exhibit a greater propensity to use online information compared to older cohorts.

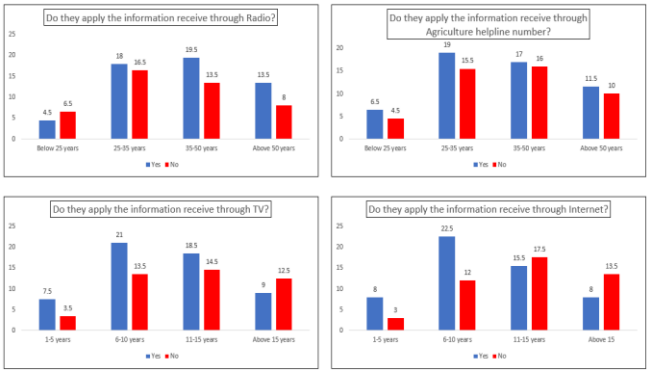

Figure 5. The Relationship between age of the respondents and the application of information through ICT.

The Relationship between education of the respondents and the application of information through ICT

***The Relationship between education of the respondents and the application of information via radio*:** Table 4 and Figure 6 analyze the extent to which individuals utilize information obtained from radio and agriculture hotlines, considering their education level. A majority of 56.5% of participants used radio information, with those with limited literacy skills and those who had just completed primary education having the highest rates of engagement. However, the application rate decreases as the level of schooling increases. The chi-square test results show a statistically significant association between education level and the utilisation of radio information applications.

***The Relationship between education of the respondents and the application of information via agriculture helpline number*:** The table assesses the use of information from an agriculture helpline, considering different education levels. 57% of participants implemented the provided information, with modest variation across different levels. Chi-square tests show no significant correlation between education and hotline usage, indicating that the helpline consistently influences individuals' behaviour, regardless of their background.

***The Relationship between education of the respondents and the application of information via television*:** The study also examines the use of television-derived information within an educational context, with 38.5% of individuals using television as a source of information. The chi-square test results show no statistically significant association between education level and the application of TV information, indicating that the influence of TV is consistent regardless of individuals' educational backgrounds.

***The Relationship between education of the respondents and the application of information via internet*:** The table assesses the manner in which individuals utilize information obtained from online services, with 46% of individuals using or putting into practise the provided information. As the level of education attained increases, there is a corresponding increase in application rates. Individuals with a graduation level of education or higher exhibit the greatest application rate at 13%, while those with lower levels of education, particularly those classified as "illiterate," have lower rates of application. The statistical analysis yields a chi-square result ($p = 0.0004^*$), suggesting a statistically significant relationship between education level and the utilisation of internet-based information, highlighting the positive impact of higher education levels on the adoption of information obtained through the internet.

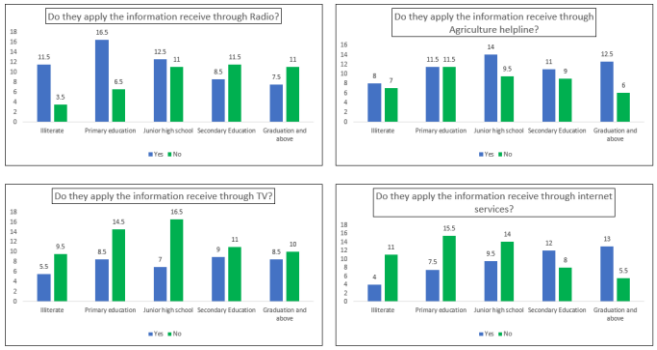

Figure 6. Relationship between education of the respondents and the application of information through ICT.

***Relationship between the respondents' farming experience and application of information received through ICT*:** ***Relationship between the respondents' farming experience and application of information received via radio*:** Table 5 and Fig. 7 show a correlation between farmers' experiences and their use of information obtained via radio. A majority of 51.5% of farmers reported using the knowledge obtained through radio sources, with an upward trend in the probability

Table 4. Relationship between education of the respondents and the application of information through ICT .

	Education					Total	Chi-square	df	p-value
	Illiterate	Primary education	Junior high school	Secondary Education	Graduation and above				
Do they apply the information receive through Radio?									
Yes	11.5%	16.5%	12.5%	8.5%	7.5%	56.5%	16.544	4	0.002*
No	3.5%	6.5%	11.0%	11.5%	11.0%	43.5%			
Total	15.0%	23.0%	23.5%	20.0%	18.5%	100%			
Chi-Square for the relationship between education of the respondents and the application of information received through Agriculture helpline									
Do they apply the information receive through Agriculture helpline?									
Yes	8.0%	11.5%	14.0%	11.0%	12.5%	57.0%	2.962	4	0.564NS
No	7.0%	11.5%	9.5%	9.0%	6.0%	43.0%			
Total	15.0%	23.0%	23.5%	20.0%	18.5%	100%			
Chi-Square for the relationship between education of the respondents and the application of information received through TV									
Do they apply the information receive through TV?									
Yes	5.5%	8.5%	7.0%	9.0%	8.5%	38.5%	3.175	4	0.528NS
No	9.5%	14.5%	16.5%	11.0%	10.0%	61.5%			
Total	15.0%	23.0%	23.5%	20.0%	18.5%	100%			
Chi-Square for the relationship between education of the respondents and the application of information received through internet services									
Do they apply the information receive through internet services?									
Yes	4.0%	7.5%	9.5%	12.0%	13.0%	46.0%	20.353	4	0.0004*
No	11.0%	15.5%	14.0%	8.0%	5.5%	54.0%			
Total	15.0%	23.0%	23.5%	20.0%	18.5%	100%			

NS Non-Significant; *Highly Significant

Table 5. Relationship between the respondents' farming experience and application of information received through ICT.

	Farming Experience (Years)				Total	Chi-square	Df	p-value
	1-5	6-10	11-15	Above 15				
Do they apply the information receive through Radio?								
Yes	3.5%	11.5%	18.5%	18.0%	51.5%	7.909	3	0.047*
No	8.5%	13.5%	15.0%	11.5%	48.5%			
Total	12.0%	25.0%	33.5%	29.5%	100.0%			
Chi-Square for the relationship between education of the respondents and the application of information received through Agriculture helpline								
Do they apply the information receive through Agriculture helpline?								
Yes	5.5%	13.0%	20.0%	19.5%	58.0%	3.866	3	0.276NS
No	6.5%	12.0%	13.5%	10.0%	42.0%			
Total	12.0%	25.0%	33.5%	29.5%	100.0%			
Chi-Square for the relationship between education of the respondents and the application of information received through TV								
Do they apply the information receive through TV?								
Yes	7.0%	11.0%	14.5%	12.5%	45.0%	1.988	3	0.574NS
No	5.0%	14.0%	19.0%	17.0%	55.0%			
Total	12.0%	25.0%	33.5%	29.5%	100.0%			
Chi-Square for the relationship between education of the respondents and the application of information received through internet services								
Do they apply the information receive through internet services?								
Yes	7.5%	9.5%	12.0%	9.0%	38.5%	7.655	3	0.053NS
No	4.5%	15.5%	21.5%	20.5%	61.5%			
Total	12.0%	25.0%	33.5%	29.5%	100.0%			

NS Non-Significant; *Highly Significant

of using such information. The Chi-square test showed a p-value of 0.047, which is below the significance level of 0.05, indicating a significant difference in the distribution.

***Relationship between the respondents' farming experience and application of information received via agriculture helpline number*:** The association between farmers' experiences and their use of information from an agriculture helpline was also examined, with 58% reporting using this knowledge. However, the data indicates a positive correlation between farming experience and the likelihood of adopting this information, suggesting that as farmers gain more expertise, they are more inclined to apply it. However, the Chi-square test revealed a p-value of 0.276, suggesting that there may not be a substantial impact of farming experience on the use of helpline information.

***Relationship between the respondents' farming experience and application of information received via television*:** The number of years farmers have been engaged in their profession and their use of information acquired from television were also evaluated. 45% of participants reported using the knowledge obtained from television sources, but a definitive correlation between individuals' experiences and their use of television as a source of knowledge remains elusive. The Chi-square test yielded a p-value of 0.574, indicating no statistically significant association between agricultural experience and the application of TV information.

***Relationship between the respondents' farming experience and application of information received via internet*:** The table and figure also assess the correlation between farmers' level of experience and their use of information obtained through online services. A notable proportion of 38.5% of participants used information obtained through the internet, but a p-value of 0.053 indicated a lack of a meaningful correlation between experience and the use of internet information.

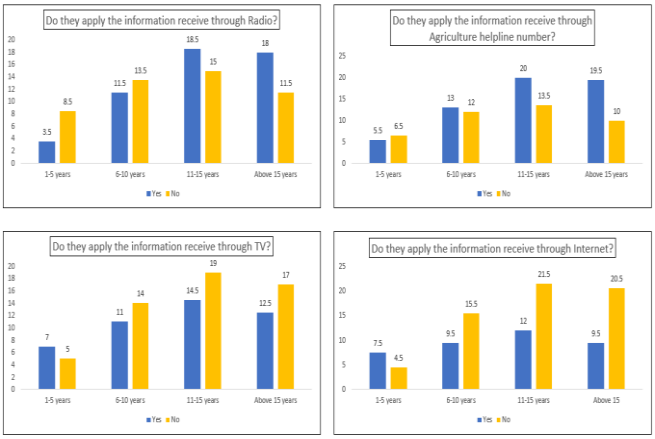

Figure 7. Relationship between the respondents' farming experience and application of information received through ICT.

Table 6. Relationship between the respondents' monthly income and application of information received through ICT.

	Monthly income (Thousand INR)						Chi-square	df	p-value
	1-10	11-20	21-30	31-40	Above 40	Total			
The information you get from Radio, do you apply that?									
Yes	0.5%	4.0%	9.5%	20.5%	14.5%	49.0%	12.269	4	0.015*
No	2.0%	11.0%	12.5%	16.0%	9.5%	51.0%			
Total	2.5%	15.0%	22.0%	36.5%	24.0%	100.0%			
Chi-Square for the relationship between the age of the respondents and the application of information received through Agriculture helpline									
Do you apply the information you receive through Agriculture helpline number?									
Yes	0.5%	6.0%	10.0%	21.5%	17.5%	55.5%	13.505	4	0.009*
No	2.0%	9.0%	12.0%	15.0%	6.5%	44.5%			
Total	2.5%	15.0%	22.0%	36.5%	24.0%	100.0%			
Chi-Square for the relationship between the age of the respondents and the application of information received through TV									
The information you get from TV, do you apply that?									
Yes	1.0%	6.0%	10.5%	22.5%	16.5%	56.5%	8.971	4	0.061NS
No	1.5%	9.0%	11.5%	14.0%	7.5%	43.5%			
Total	2.5%	15.0%	22.0%	36.5%	24.0%	100.0%			
Chi-Square for the relationship between the age of the respondents and the application of information received through Internet services									
The information you get from internet services, do you apply that									
Yes	-	4.5%	8.5%	19.5%	12.5%	45.0%	10.604	4	0.031*
No	2.5%	10.5%	13.5%	17.0%	11.5%	55.0%			
Total	2.5%	15.0%	22.0%	36.5%	24.0%	100.0%			

NS Non-Significant; *Highly Significant

***Relationship between the respondents' monthly income and application of information received through ICT*:**

***Relationship between the respondents' monthly income and application of information received via radio*:** Table 6 and Figure 8 analyse the relationship between farmers' monthly income (measured in INR) and their use of information obtained through radio and television. Around 49.0% of the sample reported using information obtained from radio, with a positive correlation between higher income brackets and increased use of radio information among farmers. The Chi-square test yielded a calculated value of 12.269 with a p-value of 0.015, suggesting a statistically significant association between income levels and the use of radio information.

***Relationship between the respondents' monthly income and application of information received via agriculture helpline number*:** The table and figure also show a positive correlation between farmers' monthly revenue (measured in thousand INR) and their use of information obtained from an agriculture helpline. Approximately 55.5% of the surveyed population indicated that they used knowledge obtained via helplines, with the highest adoption rate observed within the income range of 31,000 to 40,000. The Chi-square test yielded a test statistic of 13.505, with a p-value of 0.009, below the conventional significance level of 0.05.

***Relationship between the respondents' monthly income and application of information received via television*:** The table also shows a significant correlation between farmers' monthly income (measured in thousands of Indian Rupees) and their use of information obtained from television sources. A majority of 56.5% of participants actively utilised information obtained via television, with higher income brackets showing a greater propensity to use television as a source of information. However, the observed association lacks statistical significance when applying the conventional threshold of 0.05, suggesting that income may not have a substantial influence on the application of TV information.

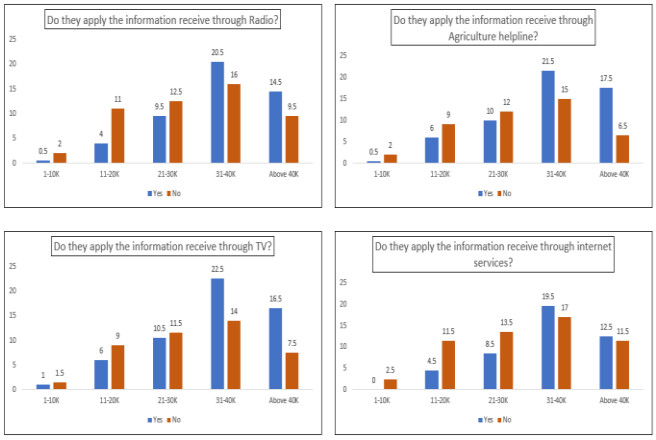

Figure 8. Relationship between the respondents' monthly income and application of information received through ICT.

***Relationship between the respondents' monthly income and application of information received via internet*:** The table also shows a significant link between wealth and the use of internet services for accessing information. Out of the entire cohort, 45.0% of participants included information sourced from the internet, with no farmers within the 1–10 thousand group reporting using this knowledge. As income rises, there is an observable pattern of increased application rates, with a particularly notable trend observed within the income bracket of 31,000 to 40,000.

DISCUSSION

ICT in agriculture transforms outdated methods into data-driven procedures, improving production, optimizing practices, and combating food security, climate change, and resource scarcity. The study reveals that larger land holdings increase productivity and efficiency in adopting modern agricultural practices. Income, which is directly related to land holding size, influences attitudes towards adopting improved agricultural technology. Rural areas, where livestock and crops are major income sources, may have less perception of TV broadcasts due to lack of education, internet facilities, and internet accessories. The similar findings were found by (Chhachhar *et al.,* 2014; Rajoria *et al.,* 2017; Gopinath 2019; Raza *et al.,* 2020; Anselme *et al.,* 2021; Imam *et al.,* 2021).

The study found that most of participants actively used radio information, with less aged 35-50. However, no significant difference was found in application rates, suggesting random chance. Younger participants, particularly those aged 25-35, showed greater propensity to use online information. The same results were shown by (Agu 2013; Das *et al.,* 2014; Verma *et al.,* 2014; Gopinath 2019; Raza *et al.,* 2020; Rengaraj and Shibu 2020; Imam *et al.,* 2021).

The result of the study shows that majority of participants use radio and agriculture hotlines, with limited literacy and recent primary education having the highest engagement rates. Application rates decrease with schooling, and no significant correlation exists between education and hotline usage. The same results were shown by (Adegbidi *et al.,* 2012; Das *et al.,* 2014; Kale *et al.,* 2015; Syem & Raj 2015; Lokeshwari 2016; Salam & Khan 2020).

Our result revealed that a correlation between farmers' experiences and information use via radio and an agriculture helpline, with 51.5% using radio knowledge, 45% using television knowledge, and 38.5% using internet information. The same results were shown by (Adegbidi *et al.,* 2012; Das *et al.,* 2014; Kale *et al.,* 2015; Syem & Raj 2015; Khan *et al.,* 2016; Lokeshwari 2016; Francis *et al.,* 2019).

It was observed that significant correlation between farmers' income and their use of radio and television information. The highest adoption rate was found in the 31,000 to 40,000 income range, with 55.5% using agriculture helpline

information. The same results were shown by (Adegbidi *et al.*, 2012; Albert 2014; Das *et al.*, 2014; Lokeshwari 2016; Hudson *et al.*, 2017; Francis *et al.*, 2019; Khan *et al.*, 2020; Shrestha and Sathvik, 2021).

***Conclusion*:** A study surveyed 200 middle-income individuals with agricultural experience, revealing a significant presence of these individuals. 36% of respondents found radio broadcasts effective, while TV broadcasts struggled with content quality and accessibility. The study found that 55.5% of participants actively used information, with the age group from 35 to 50 having the most applications. Younger age cohorts were more likely to use online information. Radio usage was higher among those with limited literacy skills and recently completed primary education, while TV usage decreased with schooling levels. Online services were utilized by 46% of participants. The study found a correlation between farmers' experiences and information usage, with 51.5% using radio sources and 58% using agriculture helpline information. Monthly income significantly influenced information usage, with higher income brackets showing increased use. Wealth also influenced internet access.

The research emphasizes the need for extension service professionals to be equipped with modern ICT tools through training and capacity-building programs, and to educate farmers on effective ICT usage for agricultural information, despite the challenge.

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***Consent to participate*:** All authors participated in this research study.

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